devoted to the lower forms, the specimens selected being enormously magnified, coloured, and exhibiting all details both of external and internal structure.

"THE Year Book of Facts in Science and the Arts," edited by James Mason (Ward, Lock, and Co.), is little better than a scrap-book of cuttings from various papers; we don't suppose it is seriously intended to represent the science of the past year.

MESSRS. HARDWICKE AND BOGUE have issued a second edition, "revised and corrected," of Mr. M. P. Edgeworth's work on "Pollen," noticed in our columns on its first publication (NATURE, vol. xvi. p. 499).

AT the last meeting, December 6, of the Russian Geographical Society, Col. Rykatchoff made a communication on the difficulty of organising observations on rain and storms.—Prof. Meller made a very interesting communication on the former connection between the Sea of Azov and the Caspian. The character of the geological formations on the tract between both seas proves without doubt that during the tertiary epoch the waters of both were connected; thus organic remains of Caspian origin are found within eighty-seven miles from the actual shores of the Sea of Azov.

AT the last meeting of the St. Petersburg Physical and Chemical Society, Prof. Beketoff made a communication on the atomic heat-capacity of hydrogen when mixed with palladium. He determined it as equal to 5·86, *i.e.*, very near to that of copper and silver.

THOSE of our readers who are in the habit of using chemical apparatus should get the Revised List just issued by Mr. Fletcher, of Warrington, who deserves credit for the very successful efforts he makes to introduce improvements into this department.

THE much-talked-of canal between Delaware and Chesapeake Bays, which will shorten the water-route from Baltimore to New York and Europe by 225 miles, is now at last to be constructed. Its length will be seventeen miles, and the cost is estimated at four million dollars. It will run through the Sassafras Valley and will have no locks.

THE additions to the Zoological Society's Gardens during the past week include a Punjaub Wild Sheep (*Ovis clyclóceros*) from India, presented by Col. W. R. Alexander; two Californian Quails (*Callipepla californica*) from California, presented by Mr. William Turquand; seven Brown Tritons (*Geotriton fuscus*), South European, presented by Prof. H. H. Giglioli, C.M.Z.S.; a Feline Dowrocouli (*Nyctipithecus felinus*) from South America, purchased.

FURTHER RESEARCHES ON THE SCINTILLATION OF STARS

SINCE last we reviewed M. Montigny's valuable researches on the scintillation of stars (vol. xviii. p. 292) he has again published some highly interesting details. The researches now in question refer specially to the changes of colour which characterise the scintillation of the *red* and *orange* stars. M. Montigny tried to solve the question whether the changes of colour in scintillation follow certain definite laws; whether, for instance, their relative frequency expressed in numbers, shows differences which depend on the nature of the star's own light, on the star's elevation above the horizon, or on the condition of the atmosphere.

In order to solve this complicated question, it was divided into its several parts. First of all M. Montigny investigated the influence of the star's own light and that of the condition of the atmosphere upon those colours which characterise the scintillation of the stars of the so-called third type. Our readers will remember that these are the stars which show black lines as well as dusky bands in their spectra; they are generally of a red or orange colour, and mostly variable. There are not many fine stars in this class, the most remarkable ones are about thirty in number, and M. Montigny has examined only the following fifteen:—β Andromedæ, α Ceti, ρ Persei, Aldebaran, Betelgeuze, α Hydræ, Arcturus, δ Virginis, δ Coronæ, α Serpentis, Antares, α Herculis, γ Aquilæ, and β and ϵ Pegasi. The evenings of observation now number 476, and reach from October, 1870, to February, 1878.

The way in which the observations were made was the following:—After each evening of observation not only the values for the intensity of scintillation were entered for each star, reduced to a distance of 60° from the zenith, but each single colour observed in the circular image was also noted down. Further, the observations made in wet weather were noted separately from those made during dry weather. Finally the various colours were entered on a table divided into seven columns, respectively headed—red, orange, yellow, green, blue-green, blue, and violet. The sum total of any column thus indicates the number of times which the colour in question was observed in a certain star. Arcturus, for instance, in 131 observations during moist weather, showed the red colour 130 times and blue 118 times. These numbers thus express the absolute frequency of these two colours. If we compare the number 130 for red, with the sum total of all colours shown by Arcturus during rainy weather, which is 491, then we obtain the relative frequency of red, which is 0·265, or multiplied by 1000 = 265. Therefore in 1000 changes of colour which appeared in Arcturus during rainy weather, red occurred 265 times, and blue 240 times.

In the following table we give the average frequencies of the different colours for the fifteen stars of the third type enumerated above; line A shows the frequencies observed in rainy weather, and B those observed in dry weather. The total of observations was 800 for A and 368 for B; the totals of the changes of colour observed were 2,982 for A and 1,368 for B.

	Intensity.	Red.	Orange.	Yellow.	Green.	Blue-green.	Blue.	Violet
A ...	60	272	194	239	57	4	230	3
B ...	43	278	213	222	63	5	216	4
Average	52	275	204	230	60	5	223	4

We observe in this table that (1) the relative frequency of red is far greater than that of any other colour in rainy weather as well as in dry; (2) red, green, and particularly orange are seen more frequently in dry weather than in wet; (3) the frequency of yellow and blue is on the contrary greater in wet weather than in dry.

Although the differences in the frequency of one and the same colour, according to the state of the atmosphere, are rather limited, they nevertheless indicate an important fact. It is also remarkable that the numeric differences in the complementary colours red and green on the one hand, and blue and yellow on the other, lie in the same direction. It is further worthy of notice that the greater frequency of blue in rainy weather agrees well with the fact that blue greatly predominates during such weather in the image of the star as shown by the scintillometer. This predominance of blue has also been frequently observed a short time previous to rainy weather.

The following table will be found interesting, as it contains the changes of colour and intensity of scintillation of the six brightest stars of the third type. In line I. are those of Betelgeuze, which is orange coloured, and the spectrum of which shows numerous broad bands, dissolvable into lines; line II. gives those of Aldebaran, pale red, whose changing spectrum has many well-defined lines and dark bands; line III. represents Arcturus, yellow-orange, with numerous dark lines not united into bands in its spectrum; line IV. gives those of α Hydræ, a yellow star with very dark lines in the spectrum; line V. those of Antares, red, with wide bands and very distinct lines; and line VI. those of α Herculis, yellowish red, with black lines and dark bands.

	Intensity.	Red.	Orange.	Yellow.	Green.	Blue.	Violet.
I. Betelgeuze ..	65	255	190	234	106	202	13
II. Aldebaran ...	62	255	186	232	104	210	13
III. Arcturus ...	61	253	120	246	130	219	32
IV. α Hydræ ...	55	284	162	253	113	188	—
V. Antares ...	53	266	121	245	130	219	33
VI. α Herculis ...	47	275	225	232	51	217	—
Average	57	265	167	240	106	209	15

These values show that the relative frequencies of the three principal colours, red, orange, and blue, remain within narrow limits for the six stars. Yet red seems to increase in frequency in the three last stars, two of which are of a decided red tint,

and whose intensity of scintillation is far smaller than that of the other three. With regard to the effect of the star's own colour it must be remarked that the relative frequency of that colour or of a nearly related one is often very great; thus, for instance, yellow is very frequent in the yellow star α Hydræ, and orange in the orange stars Betelgeuze and α Herculis. The total number of observations M. Montigny made of these six stars was 574.

For the sake of comparison M. Montigny has calculated the relative frequency of colours in two stars of the second type, to which, as our readers will remember, our own sun belongs too. The stars selected were Pollux, with a very characteristic spectrum, and Capella, which scintillates with great regularity. Both stars are yellow and their spectra show very thin dark lines. The average frequency of colours for these two stars is given separately, A in rainy weather, and B in dry weather, from a total number of 267 observations of Capella and 116 observations of Pollux.

	Intensity.	Red.	Orange.	Yellow.	Green.	Greenish blue.	Blue.	Violet.
A ...	88	281	88	280	86	7	250	8
B ...	63	299	41	304	122	26	194	14
Average	76	290	65	292	104	17	222	11

If we compare these results with the former ones we find the frequency of red and particularly that of yellow to be considerably greater in Capella and Pollux than in stars of the third type, while the frequency of orange is very much less, having decreased from 204 to 65. The influence of the weather was equally apparent in these stars; in dry weather red was more frequent, and in rainy weather blue. The relative values of green and violet are greater in these two stars than in the fifteen stars of the third type; probably these colours will become more important when the observations are extended in a larger measure to the stars of the two first types.

It is therefore proved beyond doubt, by the results above mentioned, that the changes of colour which characterise the scintillation of stars, are subject to general laws which are quite as regular and fixed as those which govern the changes in the intensity of the phenomenon as we pass from one type to another, or under the influence of rain and fine weather.

In one of the last numbers of the *Bulletin* of the Brussels Royal Academy of Sciences M. Montigny publishes the results of some researches concerning the influence of the aurora borealis on the scintillation of stars. We may return to this subject at a future date.

NOTES FROM NEW ZEALAND

MR. T. H. POTTS, of Ohinitahi, N.Z., sends us the following notes:—

Which Species of Pinus have Cones really Sessile?—In working up the habits of a collection of pines one has felt a difficulty in understanding why certain cones should be termed sessile; for example, the cone of *P. tuberculata* is described by Gordon in his "Pinetum;" also by Broun, in his "Forester," as "quite sessile." Why? Can such a description be correct at its early stage of life? It is then perched on a scaly foot-stalk, well developed; months elapse, its increasing bulk is protected with needle-pointed scales, its foot-stalk becomes curved, but is plainly visible; the mature cone, grey and glossy, clings tightly to its stem, it can scarcely be removed therefrom without tearing off a shell of bark adhering to the nasal scales; when wrenched off it shows a portion of its curved foot-stalk that has been embedded in the growing stem.

A very similar habit may be observed in *P. insignis*. Should not the cones of *P. tuberculata* and those of other species showing a similar habit, be described rather as *apparently sessile* than as "quite sessile"?

It may be mentioned that here *P. tuberculata* bears cones not only on the stem and main branches, but also on the soft green shoots of the outer branches, this would in part account for the foot-stalks becoming embedded in the growing bulk of the shoot.

P. insignis here bears cones of longer dimensions than those given by the authors before named; five specimens measure rather over seven inches in length, with a circumference of eleven inches.

Heredity.—One of my sons returning from a visit to the Chatham Isles, brought back with him a young pup of a famous colly breed. As soon as it was grown enough to run about it displayed an unusual excitement in the presence of horses by jumping upwards repeatedly towards their heads. As this trick or vice was unknown or unpractised by any of our dogs, it was, of course, soon remarked. On inquiry of a Chatham Island settler, I found this was a common trick in the colly family. "Bell" sprang from; so Bell faithfully held to the habits of her race.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

THE following programme of the Natural Science Courses in Trinity College, Dublin, may be of interest to our readers:—In the Junior Sophister year natural science is represented by two courses—one in zoology, the other in botany. Students attending a course of lectures in natural science are examined three times during the term on the subjects of the lectures, and no student is allowed credit for his attendance who does not answer sufficiently. In the Senior Sophister year natural science is represented by one course in geology. In each term examinations are held of those students in the Junior and Senior Sophister classes who are qualified to become candidates for honours. At the Michaelmas examination in the Junior Sophister year prizes of 4*l.* and of 2*l.* are awarded by the Board, on the recommendation of the Honour Examiners, to the best answerers among the candidates. At the Hilary and Trinity examinations of the Junior and Senior Sophister years honours without prizes are awarded—of which honours there are two ranks. At the Michaelmas examination of the Senior Sophister year, examinations for Moderatorships are held. The Senior Moderators receive gold medals, and the Junior Moderators silver medals, which are given to them publicly before the University, by the Chancellor, at the commencements, when they are admitted to their degrees. The First Senior Moderator receives a large gold medal if specially recommended by the Court of Examiners. The subjects of examination for the Moderatorships in natural science are the following, each of which has equal weight:—1. Physical Geography, Geology, and Palæontology. All the ordinary and honour courses of the Sophister years. A limited course to be announced each year. Course for 1879:—The Silurian Period. 2. General and Physiological Anatomy. A limited course to be announced each year. Course for 1879:—Circulation and Respiration. The Circulatory and Respiratory Organs in Mammals. The Respiration and Assimilation in Plants. 3. Zoology and Botany. All the ordinary and honour courses of the Sophister years. A limited course to be announced each year. Zoological Course for 1879:—The Non-Placental Mammals. Botanical Course for 1879:—The Fucoids. The Professors of Zoology, Botany, and Geology, give each a course of demonstrations and a course of lectures in each term, especially meant for Junior Sophisters. The Museum of Comparative Anatomy and Zoology is open, under the superintendence of the professor, to all students, to whom every facility is given for the prosecution of their studies. For the purposes of study fresh specimen of plants are, under the superintendence of the professor, to be had by the student from Mr. Frederick Moore, at the College Botanical Gardens, at Lansdowne Road; and a large number of mounted specimens of cryptogamic plants are also to be seen and examined in the herbarium. The Museum of Geology and Palæontology is open to the students attending the course.

THE Science and Art School of St. Thomas' Charterhouse Institution, Goswell Road (the largest in the United Kingdom), under the direction of the vice-chairman of the London School Board, commenced a new term on Monday evening the 6th inst. Since the commencement of the present session upwards of 600 of our elementary school teachers of London have taken advantage of the privileges offered by the classes. The attendance at the classes for experimental work in chemistry and physics has been very large.

SCIENTIFIC SERIALS

Journal of the Franklin Institute, November, 1878.—Some time ago Prof. Thurston invented apparatus for re-determining the coefficients of friction of lubricated surfaces, and the laws governing such friction, for a wide range of temperatures, pressures, and velocities. The machines have been in use about five